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TITLE: COPOLYCARBONATE POLYMER FOR BINDER OF
ELECTROPHOTOGRAPHIC PHOTORECEPTOR AND ITS PRODUCTION

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ABSTRACT:

PURPOSE: To obtain a copolycarbonate polymer composed of specific structural units, etc., at specific ratios, having a prescribed intrinsic viscosity, exhibiting excellent solubility in solvent, light resistance and abrasion resistance and useful as a binder resin for electrophotographic photoreceptor.

CONSTITUTION: This copolycarbonate polymer is composed of (A) 1-60mol% (based on the total composition) of the structural units expressed by formula I [R1 to R8 are each H, a halogen, a 1-5C alkyl, a 6-12C aryl, etc.; X is O-(CH2 O-)a, (CH2-). ((a) is 0-20), etc.] and derived from 2,2'-methylenebis[4-(1,1,3,3- tetramethylbutyl)-6-(2H-benzotriazol-2-yl)phenol, etc., and (B) the structural units of formula II (R9 to R12 are each H, a halogen, a 1-5C alkyl, etc.; Y is S, O, etc.) and derived from 2,2-bis(4-hydroxyphenyl)propane, etc., and has an intrinsic viscosity [η] of 0.3-2.00dl/g. The

copolycarbonate polymer can be produced by reacting a dihydric phenol of formula III and a dihydric phenol of formula IV with a compound capable of forming a carbonic acid ester.

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Notes:

1. Untranslatable words are replaced with asterisks (* **).
2. Texts in the figures are not translated and shown as it is.

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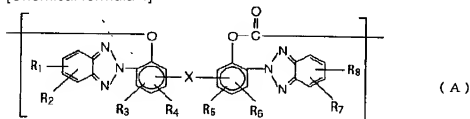
Dictionary Last updated 08/17/2009 / Priority: 1. Chemistry

CLAIM + DETAILED DESCRIPTION

[Claim(s)]

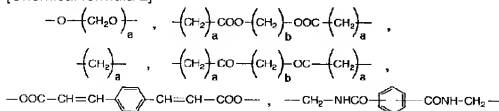
[Claim 1] It has a structural unit denoted by following general formula (A) and a general formula (B), and structural units of a general formula (A) are 1 in all the composition - 60-mol%, and it is limiting viscosity. A copoly carbonate polymer for electro photography photo conductor binders whose $[\eta]$ is 0.30 - 2.00 dl/g.

[Chemical formula 1]

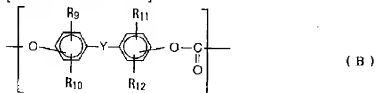


R_1 in a formula - R_8 -- hydrogen, fluorine, chlorine, bromine, and iodine. An alkyl group of the carbon numbers 1-5, an aryl group of the carbon numbers 6-12, an alkenyl group of the carbon numbers 2-5, They are an alkoxy group of the carbon numbers 1-5, and an aralkyl group of the carbon numbers 7-17, Carbon of these groups may be substituted by halogen chosen from an alkyl group of the carbon numbers 1-5 or an alkenyl group, an alkoxy group of the carbon numbers 1-5, fluorine, chlorine, bromine, and iodine, or dimethyl polysiloxy group. X is a group expressed below and a and b are the integers of 0-20.

[Chemical formula 2]



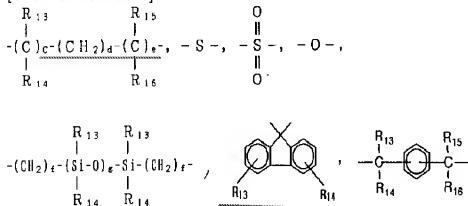
[Chemical formula 3]



the inside of a formula, $\text{R}_9 - \text{R}_{12}$ -- respectively -- hydrogen, fluorine, chlorine, and bromine.

Iodine, the alkyl group of the carbon numbers 1-5, the aryl group of the carbon numbers 6-12, They are an alkenyl group of the carbon numbers 2-5, an alkoxy group of the carbon numbers 1-5, and an aralkyl group of the carbon numbers 7-17, Carbon of these groups may be substituted by the halogen chosen from the alkyl group of the carbon numbers 1-5 or an alkenyl group, the alkoxy group of the carbon numbers 1-5, fluorine, chlorine, bromine, and iodine, or the dimethyl polysiloxy group. Y is a group expressed below.

[Chemical formula 4]



$\text{R}_{13} - \text{R}_{16}$ express hydrogen, the alkyl group of the carbon numbers 1-5, an alkenyl group, an alkoxy group or the carbon number 6 - 12 aryl groups here, respectively, or $\text{R}_{13} - \text{R}_{16}$ combine them with it together, The group which forms a ring or heterocycle is expressed and carbon of these groups may be substituted by the halogen chosen from the alkyl group of the carbon numbers 1-5 or an alkenyl group, the alkoxy group of the carbon numbers 1-5 or fluorine, chlorine, bromine, and iodine. c d and e express the integer of 0-20, and f and g express the integer of 1-100.

[Claim 2] A structural unit denoted by a general formula (A) A 2,2'-methylenebis[4-(1,1,3,3-tetramethylbutyl)-6-(2H-benzotriazol 2-yl) phenol], A 4,4'-hexamethylene dicarboethoxyscrew [2-t-butyl-6-(2H-benzotriazol 2-yl) phenol], The copoly carbonate polymer for electro photography photo conductor binders according to claim 1 derived from a 2,2'-methylenebis[4-methyl-6-(2H-benzotriazol 2-yl) phenol].

[Claim 3] A structural unit denoted by a general formula (B) 2,2-bis(4-hydroxyphenyl)propane,

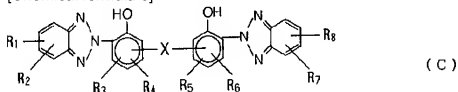
1,1-bis(4-hydroxyphenyl)cyclohexane, 2,2-bis(4-hydroxy-3-methylphenyl)propane, An 1,1-screw (4-hydroxyphenyl)-1-Phenylethane, bis(4-hydroxyphenyl)ether, the copoly carbonate polymer for electro photography photo conductor binders according to claim 1 derived from bis (4-hydroxyphenyl)sulfide.

[Claim 4]The copoly carbonate polymer for electro photography photo conductor binders according to claim 1 whose structural unit denoted by a general formula (A) is 5in all the composition -40mol %.

[Claim 5]The copoly carbonate polymer for electro photography photo conductor binders according to claim 1 used as a charge transport layer binder of a two-layer type electro photography photo conductor in which a charge transport layer was formed on a charge generating layer.

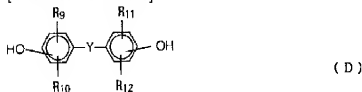
[Claim 6]A manufacturing method of the copoly carbonate polymer for electro photography photo conductor binders according to claim 1 making dihydric phenol denoted by a following general formula (C), and dihydric phenol denoted by a following general formula (D) react to a carbonate formation nature compound.

[Chemical formula 5]



(X and $R_1 - R_8$ express the respectively same meaning as the thing in said formula (A) among a formula.)

[Chemical formula 6]



(Y and $R_9 - R_{12}$ express the respectively same meaning as the thing in said formula (B) among a formula.)

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention has the structure derived from specific bisphenol more particularly with respect to the polycarbonate polymer for electro photography photo conductor

binders, and relates to the copoly carbonate polymer for electro photography photo conductor binders excellent in solution characteristics, a mechanical property, lightfastness, electrophotographic properties, etc.

[0002]

[Description of the Prior Art]Now, electrophotographic technology is widely applied to a copying machine, a laser printer, a facsimile, etc. by being the rapidity and high definition etc. As an electro photography photo conductor in this electrophotographic technology, inorganic system photoconductivity substances, such as selenium, selenium / tellurium alloy, selenium / arsenic alloy, and cadmium sulfide, have mainly been used conventionally. However, these days, the electro photography photo conductor which uses an organic system photoconductivity substance is developed from points, such as toxicity, safety, a price, and productivity. When this organic system photoconductivity substance is a low-molecular substance, mixing with binder resin and forming a paint film is usually performed.

[0003]As binder resin, polymethylmethacrylate, polystyrene, Various kinds of thermoplastics and thermosetting resins, such as vinyl polymerization objects, such as polyvinyl chloride, and the copolymer of those, polycarbonate, polyester, polysulfone, phenoxy resin, an epoxy resin, and silicone resin, have been used.

[0004]The polycarbonate resin which has characteristics comparatively outstanding among these various resin is used well, and using various polycarbonate resin as binder resin is reported. For example, to JP,60-172044,A, [polycarbonate resin from the bisphenol Z] To JP,63-170647,A, [polycarbonate resin from bisphenol A] It is indicated by JP,63-148263,A that polycarbonate resin from bisphenol A P uses it for JP,H4-44048,A as binder resin again, respectively in polycarbonate resin from dimethylbisphenol A. Since bisphenol A type polycarbonate is especially inexpensive, since the solubility over a solvent is good, bisphenol Z type polycarbonate is used widely as binder resin.

[0005]In the electro photography photo conductor (OPC photo conductor) which uses these publicly known organicity system photoconductivity substance (OPC) and various binder resin, what is equal to the electro photography photo conductor which uses an inorganic system photoconductivity substance in respect of sensitivity etc. is obtained. These OPC(s) photo conductor can be easily made into a thin film by the cast producing-film method etc., and can be mass-produced, and its price is also comparatively inexpensive. While an OPC photo conductor has the field outstanding in this way, deterioration of binder resin, abrasion resistance, etc. by repetition exposure may not necessarily be enough over a long period of time, and an improvement is desired as binder resin.

[0006]The polycarbonate which has benzotriazol structure as polycarbonate which, on the other hand, has the ultraviolet absorption nature excellent in weatherability is known by JP,H3-39326,A. However, it is not indicated at all whether the physical properties which excelled

when this polycarbonate used it as that it can apply as resin for OPC binders and resin for OPC binders are shown.

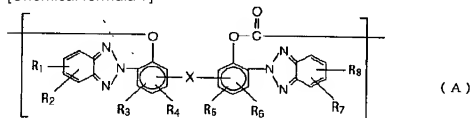
[0007]

[Means for solving problem]The result of having repeated examination wholeheartedly this invention persons solving the conventional technical problem in binder resin for electro photography photo conductors, The copoly carbonate polymer derived from the dihydric phenol which has a specific benzotriazol structure, and at least one or more kinds of other dihydric phenol compares with the conventional binder resin for electro photography photo conductors, While excelling in lightfastness and abrasion resistance, the unexpected effect of raising the sensitivity of OPC is found out, and based on this knowledge, it came to complete this invention.

[0008]That is, it has a structural unit denoted by the following general formula (A) and a following general formula (B), and the structural units of a general formula (A) are 1 in all the composition - 60-mol%, and this invention is limiting viscosity. $[\eta]$ is related with a copoly carbonate polymer for electro photography photo conductor binders which is 0.30 - 2.00 dl/g, and a manufacturing method for the same.

[0009]

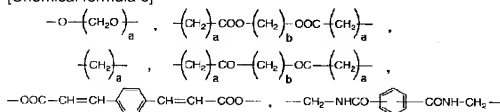
[Chemical formula 7]



[0010] R_1 in a formula - R_8 -- hydrogen, fluorine, chlorine, bromine, and iodine. The alkyl group of the carbon numbers 1-5, the aryl group of the carbon numbers 6-12, the alkenyl group of the carbon numbers 2-5, They are an alkoxy group of the carbon numbers 1-5, and an aralkyl group of the carbon numbers 7-17, Carbon of these groups may be substituted by the halogen chosen from the alkyl group of the carbon numbers 1-5 or an alkenyl group, the alkoxy group of the carbon numbers 1-5, fluorine, chlorine, bromine, and iodine, or the dimethyl polysiloxy group. X is a group expressed below and a and b are the integers of 0-20.

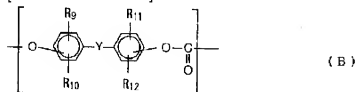
[0011]

[Chemical formula 8]



[0012]

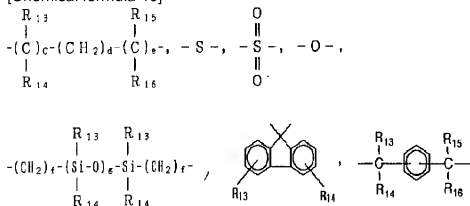
[Chemical formula 9]



[0013]the inside of a formula, $R_9 - R_{12}$ -- respectively -- hydrogen, fluorine, chlorine, and bromine. Iodine, the alkyl group of the carbon numbers 1-5, the aryl group of the carbon numbers 6-12, They are an alkenyl group of the carbon numbers 2-5, an alkoxy group of the carbon numbers 1-5, and an aralkyl group of the carbon numbers 7-17, Carbon of these groups may be substituted by the halogen chosen from the alkyl group of the carbon numbers 1-5 or an alkenyl group, the alkoxy group of the carbon numbers 1-5, fluorine, chlorine, bromine, and iodine, or the dimethyl polysiloxy group. Y is a group expressed below.

[0014]

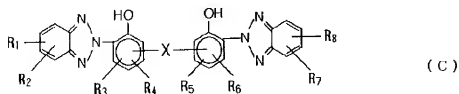
[Chemical formula 10]



[0015] $R_{13} - R_{16}$ express hydrogen, the alkyl group of the carbon numbers 1-5, an alkenyl group, an alkoxy group or the carbon number 6 - 12 aryl groups here, respectively, or $R_{13} - R_{16}$ combine them with it together, The group which forms a ring or heterocycle is expressed and carbon of these groups may be substituted by the halogen chosen from the alkyl group of the carbon numbers 1-5 or an alkenyl group, the alkoxy group of the carbon numbers 1-5 or fluorine, chlorine, bromine, and iodine. c d and e express the integer of 0-20, and f and g express the integer of 1-100.

[0016]Dihydric phenol as which the copoly carbonate which has said general formula (A) and a structural unit of (B) in this invention is expressed in a following general formula (C), [0017]

[Chemical formula 11]

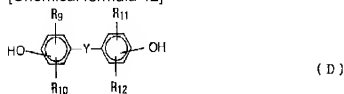


[0018](X and $R_1 - R_8$ express the respectively same meaning as the thing in said formula (A) among a formula.)

[0019]The dihydric phenol denoted by a following general formula (D) can be made to be able to react to a carbonate formation nature compound, and can be manufactured.

[0020]

[Chemical formula 12]



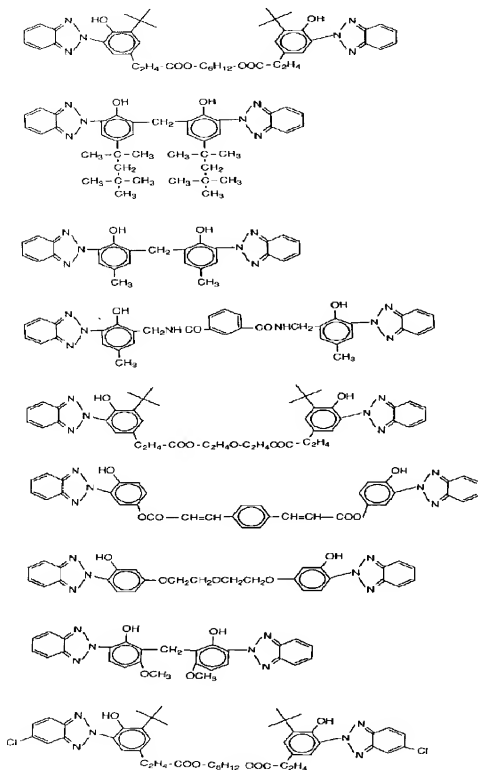
[0021](Y and $R_9 - R_{12}$ express the respectively same meaning as the thing in said formula (B) among a formula.)

[0022]** with the benzotriazol structure denoted by said general formula (C), [dihydric phenol] A publicly known method, for example, a nitroaniline derivative, is diazotized by nitrous acid, and it is made to react to a phenol derivative under existence of an alkali, is considered as an azo compound, and is manufactured from carrying out reduction cyclization from zinc or a sulfur compound.

[0023]The compound which specifically illustrates below the dihydric phenol which has the benzotriazol structure denoted by said general formula (C) is mentioned.

[0024]

[Chemical formula 13]



[0025] Two or more kinds of these dihydric phenol may be combined, and it may be used. Also in it, from a point of reactivity or the stability of polycarbonate to a 2,2'-methylenescrew [4-(1,1,3,3-tetramethylbutyl)-6-(2H-benzotriazol 2-yl) phenol]. A 4,4'-hexamethylene dicarboethoxyscrew [2-t-butyl-6-(2H-benzotriazol 2-yl) phenol] 2,2'-methylenescrew [4-methyl-

6-(2H-benzotriazol 2-yl) phenol] is more preferred.

[0026][as dihydric phenol denoted by said general formula (D)] Specifically Biphenol, bis(4-hydroxyphenyl)methane, Bis(4-hydroxyphenyl)ether, bis(4-hydroxyphenyl)sulfone, Bis(4-hydroxyphenyl)sulfide, 1,1-bis(4-hydroxyphenyl)ethane, 2,2-bis(4-hydroxyphenyl)propane (bisphenol A; BPA), 2,2-bis(4-hydroxyphenyl)butane, 1,1-bis(4-hydroxyphenyl)cyclohexane (bisphenol Z;BPZ), 2,2-bis(4-hydroxy-3,5-dibromo phenyl)propane, 2,2-bis(4-hydroxy-3,5-dichlorophenyl)propane, 2,2-bis(4-hydroxy-3-bromophenyl)propane, 2,2-bis(4-hydroxy-3-chlorophenyl)propane, 2,2-bis(4-hydroxy-3-methylphenyl)propane (dimethylbisphenol A; DMBPA), 2,2-bis(4-hydroxy-3,5-dimethylphenyl)propane, 1,1-screw (4-hydroxyphenyl)-1-Phenylethane (bisphenol A P;BPAP), Bis(4-hydroxyphenyl)diphenylmethane, 2,2-bis(4-hydroxyphenyl)hexafluoropropane, alpha, omega - Bis[2-(p-hydroxyphenyl) ethyl] polydimethylsiloxane, 9,9-bis(4-hydroxyphenyl)fluorene, 2,2-bis(4-hydroxy-3- allylphenyl) propane, 4,4' - [1,4-phenylenebis(1-methylethylidene)] bisphenol, 4,4 - [1,3-phenylenebis(1-methylethylidene)] bisphenol, 4-methyl-2,4-screw (4-hydroxyphenyl)-1-Heptene etc. are illustrated. These can also use two or more kinds together.

[0027]Also especially in these, 2,2-bis(4-hydroxyphenyl)propane, 1,1-bis(4-hydroxyphenyl)cyclohexane, 2,2-bis(4-hydroxy-3-methylphenyl)propane, It is preferred to be chosen out of 1,1-bis(4-hydroxyphenyl)-1-phenylethane, bis(4-hydroxyphenyl)ether, and bis(4-hydroxyphenyl)sulfide.

[0028]On the other hand as a carbonate formation nature compound, for example Carbonyl chloride, an oxalyl chloride, or diphenyl carbonate, Bisallyl carbonate, such as di-p-tolyl carbonate, phenyl-p-tolyl carbonate, di-p-chlorophenyl carbonate, and dinaphthyl carbonate, is mentioned.

[0029][as a process of the copoly carbonate polymer of this invention] A publicly known method used when manufacturing polycarbonate from usual bisphenol, For example, methods, such as a direct reaction (phosgene method) of dihydric phenol and carbonyl chloride or an ester exchange reaction (ester interchange method) of dihydric phenol and screw aryl carbonate, are employable.

[0030]Carbonyl chloride is made to usually react to said dihydric phenol under existence of an acid binder and a solvent in the former phosgene method. As an acid binder, the hydroxide of alkali metals, such as pyridine, sodium hydroxide, potassium hydroxide, etc. are used, for example, and a methylene chloride, chloroform, chlorobenzene, xylene, etc. are used as a solvent, for example. In order to promote a polycondensation reaction, catalysts, such as a tertiary amine like triethylamine, or quaternary ammonium salt, in order to adjust a degree of polymerization, It is desirable to react by adding molecular weight modifiers, such as phenol, p-t-butylphenol, and long-chain alkylation phenol. According to a request, a little branching-ized agents, such as antioxidants, such as sodium sulfite and sodium hydrosulfite, phloroglucine,

isatin bisphenol, may be added. It is usually preferably appropriate for a reaction to consider [0-150 °C] it as the range of 5-40 °C. Although reaction time changes with reaction temperature, they are usually 1 minute - 2 hours preferably for 0.5 minute - 10 hours. It is desirable during a reaction to hold pH of the system of reaction or more to ten.

[0031]On the other hand, said dihydric phenol and screw aryl carbonate are mixed, and it is made to react in high temperature in the latter ester interchange method under a reduced pressure. 150-350 °C of reactions are usually preferably performed at the temperature of the range of 200-300 °C, and the degree of reduced pressure is preferably set to 1 or less mmHg by last, and the phenols originating in this screw aryl carbonate generated by the ester exchange reaction are made to distill off out of a system. Although reaction time changes with reaction temperature, degrees of reduced pressure, etc., it is usually about 1 to 4 hours. It is preferred to perform a reaction under inert gas atmosphere, such as nitrogen and argon. According to a request, it may react by adding an aforementioned molecular weight modifier, antioxidant, and branching-ized agent.

[0032]The viscosity of the suitable polymer for shaping can fabricate the copoly carbonate polymer of this invention by publicly known wet compaction methods, such as the solution casting method, the cast method, a spray method, and a dip painting cloth method (dip method), and according especially to a dip method is limiting viscosity. It is 0.30 - 2.00 dL/g in [eta]. Limiting viscosity[eta] becomes smaller than 0.30 dL/g, when the hardness of the film obtained by the wet compaction will fall and it will exceed 2.00 dL/g, it is not desirable the productivity by a wet compaction falls in many cases, and difficult [the treatment after a polymerization] in many cases.

[0033]From a viewpoint of the reactivity [structural unit / of the general formula (A) in the copoly carbonate polymer of this invention] of the monomer of a general formula (C), it is preferred that it is [1 in all the composition - 60 mol %], if 60-mol% is exceeded, molecular weight control will become it is remarkable and difficult, there will be many low-molecular-weight objects, and limiting viscosity will fall. 1 mol% In conventional BPA type polycarbonate and physical properties of what maintains dominance at weatherability a little in the following, or the solubility over a solvent, a difference is almost lost. When the soluble balance to good reactivity (molecular weight controllability), physical properties, and a solvent is taken into consideration, 10-40 mol % is preferred.

[0034]It is possible to blend with the copoly carbonate polymer in this invention conventionally publicly known various additives used for polycarbonate resin according to a request, and a stabilizer, an ultraviolet ray absorbent, an antistatic agent, lubricant, a release agent, a color, a pigment, a flame retarder, etc. are mentioned as these additives. For example, especially as a stabilizer, phosphorous acid or phosphite is preferred. As a release agent, mono- of saturated fatty acid or ester of a polyhydric alcohol is mentioned, and stearyl stearate, behenyl behenate,

pentaerythritol tetra stearate, dipentaerythritol hexa octoate, etc. are illustrated as a suitable thing. It is also possible to add resin, such as polyester carbonate and polyarylate, suitably besides further usual polycarbonate if needed.

[0035]The laminated type thing in which what has a photoconductive layer of a monolayer on a conductive substrate carried out functional separation may be sufficient as the electro photography photo conductor in which the copoly carbonate polymer of this invention is used as binder resin. These days, the laminated type electro photography photo conductor which consists of a bilayer of the charge generating layer which generates a charge by exposure, and the charge transport layer which conveys a charge is in use. A ***** layer, a protection layer, a glue line, etc. may be provided if needed.

[0036]Metallic materials, such as an aluminium, stainless steel, and nickel, a polyester film, a phenol resin, paper which provided conductive layers, such as an aluminium, palladium, tin oxide, and indium oxide, in the surface, etc. are used for a conductive substrate.

[0037]By a publicly known method, said charge generating layer is formed on a conductive substrate. As charge generating material, organic pigments, such as an azoxybenzene system, a JISUAZO system, tris azo, a benzimidazole system, polycyclic type quinoline, an indigoid system, a quinacridone series, a phthalocyanine system, a perylene system, and a methine system, can be used, for example. Such charge generating material the particle Polyvinyl butyral resin, Polyvinyl formal resin, silicone resin, polyamide resin, polyester resin, It is used in the form which binder resin, such as polystyrene resin, polycarbonate resin, polyvinyl acetate resin, polyurethane resin, phenoxy resin, an epoxy resin, and various cellulose, was made to distribute.

[0038]Said charge transport layer is formed by distributing a charge transportation substance (CT agent) by using the copoly carbonate polymer of this invention as binder resin by the method that it is publicly known on a charge generating layer.

[0039]As a CT agent, for example, polytetracyanoethylene; -- fluorenone system compound [, such as a 2,4,7-trinitro 9-fluorenone,]; -- nitro compound [, such as dinitro anthracene,]; -- succinic anhydride; -- maleic anhydride; -- dibromo maleic anhydride; -- triphenylmethane series compound;2. [5-JI] 1-phenyl-3- oxadiazole system compound [, such as (4-dimethylaminophenyl)-1,3,4-oxadiazole,]; -- styryl system compound [, such as 9-(4-diethylaminostyryl) anthracene]; -- carbazole system compound [, such as poly-N-vinylcarbazole,];. (p-dimethylaminophenyl) Pyrazoline system compounds, such as pyrazoline; Amine derivative;1, such as 4,4',4"-tris (N,N-diphenylamino) triphenylamine, the 1-bis(4-diethylaminophenyl)-4,4-diphenyl- 1, conjugate unsaturated compound [, such as 3-butadiene,]; -- hydrazone system compound [, such as 4-(N,N-diethylamino) benzoic aldehyde N,N-diphenylhydrazone,]; -- an indole series compound. An oxazol system compound, an isoxazol system compound, a thiazole system compound, a thiadiazole system compound, an

imidazole series compound, a pyrazole system compound, Nitrogen ring type compounds, such as a pyrazoline system compound and a triazole compound; a condensed polycyclic compound etc. are mentioned. The above-mentioned CT agent may be used alone, or may be used together two or more sorts.

[0040]A charge generating layer and a charge transport layer dissolve above-mentioned charge generating material or charge transportation substance in binder resin and a suitable solvent, respectively, apply the solution with a dip painting cloth (dip) method, a spray method, etc., and are formed by making it dry.

[0041]As this solvent, although it can divide roughly into two kinds, a halogen system organic solvent and a non halogen system solvent, generally a halogen system solvent with little combustibility is used abundantly. However, a non halogen system solvent is increasingly used from a viewpoint of safety or environmental sanitation in recent years. The copoly carbonate polymer of this invention shows high solubility to many non halogen system solvents, for example, toluene, and has the advantage that solution stability is also high.

[0042]In a non halogen system solvent, aromatic system solvents, such as benzene, toluene, and xylene, Ketone solvent, such as acetone, methyl ethyl ketone, and cyclohexanone, Ether system solvents, such as tetrahydrofuran, dioxane, and ethylene glycol diethylether, Alcoholic solvent, such as ester solvent, such as methyl acetate, ethyl acetate, and ethylcellosolve, methanol, ethanol, and isopropanol, other dimethylformamides, dimethyl sulfoxide, diethylformamide, etc. are mentioned.

[0043]Of course, the copoly carbonate polymer of this invention dissolves in a halogen system solvent, for example, a methylene chloride, chloroform, carbon tetrachloride, ethylene chloride, tetrachloroethane, chlorobenzene, etc. like conventional polycarbonate.

[0044]These solvents may be alone used regardless of a non halogen system and a halogen system, and can use two or more sorts together, and can also use them as a mixed solvent.

[0045]When using the copoly carbonate polymer of this invention as binder resin, solution concentration is usually 5 to 20 weight % preferably one to 30weight %. The mixing ratio of charge generating material and binder resin has preferred within the limits of 10:1-1:20. 0.1-2 micrometers 0.01-20-micrometer are preferably preferred for the thickness of this charge generating layer. The mixing ratio of a charge transportation substance and binder resin has preferred within the limits of 10:1-1:10. 5-30 micrometers 2-100-micrometer are preferably preferred for the thickness of this charge transport layer.

[0046]When the copoly carbonate polymer of this invention is used as binder resin of a charge transportation substance, compared with the case where conventional polycarbonate is used as binder resin, the effect that the response at the time of exposure (sensitivity) is improved appears. Even if this effect is imagined to be what the copoly carbonate polymer of this invention containing a benzotriazol skeleton is functioning on as some charge transportability

substance, therefore reduces the conventional CT dose, it holds sufficient exposure response. The abrasion resistance of a charge transport layer is improved by reducing CT agents.
[0047]

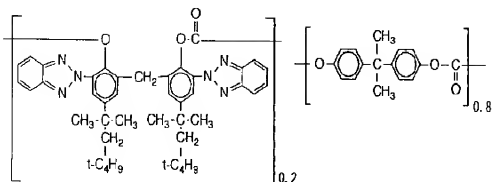
[Working example]Next, although an embodiment explains this invention still in detail, this invention is not limited at all by these examples.

[0048][570 ml of sodium hydroxide aqueous solutions of 18.8% (w/v) of an embodiment] 2,2'-methylenebis[4-(1,1,3,3-tetramethylbutyl)-6-(2H-benzotriazol-2-yl) phenol] 52.64 g (following LA31, 0.08 mol), 72.96g of 2,2-bis(4-hydroxyphenyl)propane (the following BPA and 0.32 mol) and 0.1 g of sodium hydrosulfite were added, and it dissolved. Agitating having added 360 ml of methylene chloride to this, and keeping at 15 **, 0.2 g of p-Tasha RUBUCHIRU phenol (henceforth, PTBP) and 0.05 g of benzyl chloride bird ECHIRUAN minium (henceforth, TBAC) were added, and subsequently, the carbonyl chloride 51g was spent for 50 minutes, and was blown. Agitate violently, reaction liquid is made to emulsify after the end of blowing in, and 0.2 ml of triethylamine (TEA) is added after emulsification, and it agitated for about 1 hour and was made to polymerize. After repeating a flush until it divides polymerization liquid into an aqueous phase and an organic phase, phosphoric acid neutralizes an organic phase and it becomes neutrality about the pH of a wash liquid, 470 ml of isopropanol was added and polymer was settled. After filtering settlings, it dried and powdered resin was obtained. The limiting viscosity [eta] at the temperature of 20 ** of the solution with a concentration of 0.5 g/dl in which this polymer uses a methylene chloride as a solvent was 0.47 dl/g.

[0049]As a result of analyzing the obtained above-mentioned polymer from an infrared absorption spectrum, the absorption which originates in a carbonyl group in the position near 1770cm^{-1} , and the absorption which originates in an ether linkage in the position near 1240cm^{-1} were accepted, and having carbonate binding was checked. Most absorption of hydroxyl group origin was not observed in the position of $3650 - 3200\text{cm}^{-1}$. When the monomer in this polycarbonate was measured by GPC analysis, each of LA31 and BPA(s) was 20 ppm or less. As a result of synthesizing these, this polymer is accepted to be a copoly carbonate polymer which consists of the following structural unit.

[0050]

[Chemical formula 14]

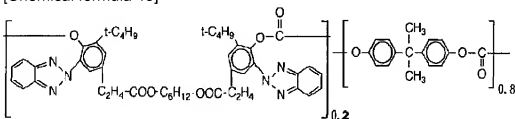


[0051]It carried out like Embodiment 1 except having changed embodiment 2LA31 into 131.6 g (0.2 mol), having changed BPA into 45.6 g (0.2 mol), having changed TBAC into TEAO.1ml and having changed PTBP into 0.15 g. The limiting viscosity $[\eta]$ of the obtained polymer is 0.41 dl/g, and except that this polymer differs in a copolymerization ratio from an infrared absorption spectrum analysis etc., it is accepted to be a copoly carbonate polymer equivalent to Embodiment 1.

[0052]It carried out like Embodiment 1 except having used 60.8g of 4,4'-hexamethylene dicarboethoxyscrews [2-t-butyl-6-(2H-benzotriazol 2-yl) phenol] (the following T840, 0.08 mol) instead of embodiment 3LA31. The limiting viscosity $[\eta]$ of the obtained polymer is 0.48 dl/g, and this polymer is accepted to be a copoly carbonate polymer which consists of the following structural unit from an infrared absorption spectrum etc.

[0053]

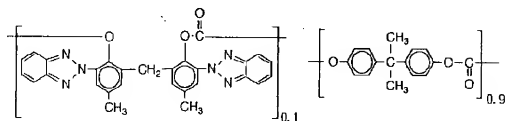
[Chemical formula 15]



[0054]Instead of embodiment 4LA31, it carried out like Embodiment 1 except having changed 2,2'-methylenescrew [4-methyl-6-(2H-benzotriazol 2-yl) phenol] 18.48g (following LA2, 0.04 mol) and BPA into 82.08 g (0.36 mol). The limiting viscosity $[\eta]$ of the obtained polymer is 0.79 dl/g, and is accepted to be a copoly carbonate polymer which consists of an infrared absorption spectrum etc. and the following structural unit.

[0055]

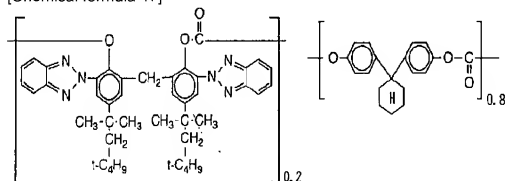
[Chemical formula 16]



[0056] Instead of embodiment 5BPA, it carried out like Embodiment 1 except having used the 1,1-bis(4 - hydroxyphenyl)cyclohexane 85.76g (BPZ, 0.32 mol). The limiting viscosity $[\eta]$ of the obtained polymer is 0.43 dl/g, and this polymer is accepted to be a copoly carbonate polymer which consists of the following structural unit from an infrared absorption spectrum etc.

[0057]

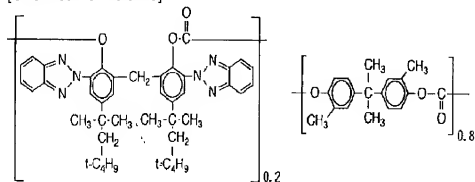
[Chemical formula 17]



[0058] Instead of embodiment 6BPA, it carried out like Embodiment 1 except having used 81.92 g (DMBPA, 0.32 mol) of 2,2-bis(4 - hydroxy-3-methylphenyl)propane. The limiting viscosity $[\eta]$ of the obtained polymer is 0.45 dl/g, and this polymer is accepted to be a copoly carbonate polymer which consists of the following structural unit from an infrared absorption spectrum etc.

[0059]

[Chemical formula 18]



[0060] 0.1 ml of TEA(s) were used instead of embodiment 7TBAC, and it carried out like

Embodiment 1 except having changed p-Tasha RUBUCHIRU phenol into 0.02 g. The limiting viscosity [eta] of the obtained polymer is 1.19 dl/g, and this polymer is accepted to be a copoly carbonate polymer which consists of a structural unit equivalent to Embodiment 1 from an infrared absorption spectrum etc.

[0061]As the copoly carbonate polymer and comparative example of Embodiments 1-7, commercial BPA type gay polycarbonate (You pyrone S-2000 Made from Mitsubishi Gas Chemical , limiting viscosity [eta] 0.5 dl/g) (comparative example 1), And the result of having performed the solubility and the light-fast measurement of a cast film to a solvent is shown in Table 1 using commercial BPZ type gay polycarbonate (You pyrone PCZ Made from Mitsubishi Gas Chemical , limiting viscosity [eta] 0.49 dl/g) (comparative example 2).

[0062]The result of having measured electrification characteristics, optical sensitivity, and abrasion resistance about what was used as the electro photography photo conductor on the following (embodiment 8) conditions is shown in Table 2, using the copoly carbonate polymer of Embodiments 1-7, and polycarbonate of the comparative examples 1 and 2 as binder resin.

[0063][embodiment 8 aluminium] [on the polyethylene terephthalate film vapor-deposited about 50 nm in thickness] Ten copies of tau ingot copper phthalocyanine, five copies of phenoxy resin, five copies of polyvinyl butyral resin, and 100 copies of dimethoxyethane were mixed, and it applied using the coating liquid which performed grinding distributed processing with the sand grind mill, and it dried and the charge generating layer about 0.5 micrometer thick was provided. 4-(N,N-diethylamino) benzoic aldehyde N,N-diphenylhydrazone (CTB) Next, 40-50 copies, The coating liquid which uses 50-60 copies and 350 copies of tetrahydrofuran for polycarbonate of Embodiment 1, Embodiment 5, and the comparative examples 1 and 2 was produced, it applied on the above-mentioned charge generating layer, and after air-drying, it dried for 8 hours, the charge transport layer about 30 micrometers thick was provided, and 100 ** of laminated type electro photography photo conductors were produced.

[0064]Evaluation of this electro photography photo conductor Electrification characteristics and optical sensitivity were investigated with Kawaguchi electricity factory EPA-8100 static electrification testing device. About abrasion resistance, it could delete using the Taber abrader by Suga Test Instruments Co., Ltd., and quantity was measured. The result was shown in Table 2.

[0065]

[Table 1]

Table One embodiment and comparative example Real 1 The real 2 fruit 3.ratio 2 dihydric-phenol real -- 4 -- real -- 5 -- real -- 6 -- real -- 7 -- the ratio 1. (C) LA31 LA31 T840 LA2. BP1 BP1 BP1 ---. (mol%) 20 50 20 10 20. 20 20 --- Dihydric phenol . (D) BPA BPA BPA BPA BPZ. DMBP BPA BPA BPZ (mol%). 80 50 80 90 80 80 80. 100 100 limiting-viscosity (dl/g)

0.47. 0.41 0.48 0.79 0.43. 0.45 1.19 0.49IR 0.50 (carbonate .) **** with joint **** * . It is. **** The **** residual monomer (ppm). ND ND ND ND ND ND NDND. ND solvent solubility A A A A A A B A solvent TO TO TO DO TO TO DO TO TO lightfastness (dl/g) -- 0.44 0.40 0.45 0.73 0.41 0.42 1.14 0.41 0.38[(notes) In the inside of front "fruit", a "ratio" means a comparative example for an embodiment.]

[0066]The description in front is depended below.

BPA : [A 2,2-screw (4- hydroxyphenyl)] Propane BPZ - methylenescrew [4 : 1,1-bis(4-hydroxyphenyl)cyclohexane DMBPA : 2,2-bis(4-hydroxy-3-methylphenyl)propane LA31 : 2,2' - (3- 1, 1, 3) Tetramethylbutyl-6-(2H-benzotriazol 2-yl) Phenol]T840 : 4,4'-hexamethylene diethoxy carbonyl screw [2-t- Butyl-6- (2H- benzotriazol 2-yl). Phenol]LA2 : 2,2'- methylenescrew [4-methyl-6- (2H- benzotriazol 2- yl) Phenol TO : Toluene DO : 1 and 4-Dioxane [0067]From IR infrared absorption spectrum, absorption by the carbonyl near 1770cm^{-1} and absorption by the ether linkage near 1240cm^{-1} were checked.

[0068]GPC by residual monomer Waters performed the separation fixed quantity for the monomer component. ND shows 20 ppm or less below by a limit of detection.

[0069]Each 100-cc solvent is added to each polycarbonate of 10 g of solvent solubility, and it is visual observation about the state of the solution after neglecting it to an ultrasonic cleaner for 10 minutes. (A:transparent B: Those with an undissolved thing)

[0070]The abrasion loss after a wear-resistant 1000 taper abrasion test (300 g of load and CS-17 ring) round trip is measured.

[0071]Limiting viscosity[eta]

It is limiting viscosity at 20 ** about a 0.5g/100cc dichloromethane resin solution. [eta] (dl/g) It asked.

[0072]Limiting viscosity (dl/g) after the 1000-hour fading resistance test by light-fast examination Suga Test Instruments Co., Ltd. make sunshine weather meter WEL-SUN-DC.

[0073]

[Table 2]

A table 2 electrical-property abrasion resistance binder CTB : Binder .Vo DD Vr E1/2 Abrasion loss resin . the mixing ratio -- (-v) (V) (-v) (lux.) - sec (mg) embodiment 1 50:50. 638 15 15 1.4 3.11 embodiments 1. 40:60 645 19 17 1.3. 2.56 Embodiment 5 50:50652 14 13 1.4 3.06 Embodiment 5 40:60 667 20 18 1.2 2.42 Comparative example 1 50:50 604 22 20 1.1 3.55 comparative examples 2 50:50 620 19 10 1.2 3.04[0074]CIB : so that 4-(N,N-diethylamino) benzoic aldehyde N,N'-diphenylhydrazone Vo:50 μA electric current may flow into an aluminium. Initial electrification quantity (-V) DD taper abrasion test when it sets up: It is (V)Vr by the electric potential fall after after-electrification 2-second neglect. : Rest potential (- V) E1/2 5 seconds after exposure (:): Quantity of light taken to attenuate electrification potential to one half (exposure hardness 6lux) = sensitivity abrasion resistance: [300 g of load] CS-17

The abrasion loss after a 1000 ring round trip is measured.

[0075]

[Effect of the Invention]The copoly carbonate polymer concerning this invention has the lightfastness which was excellent when using as electro photography photo conductor binder resin, and the solubility over a solvent. And since electro photography sensitivity improves, a charge transportability substance can be reduced, and also abrasion resistance improves further. Therefore, it is suitable as binder resin of a field in which electro photography photo conductors, such as a copying machine, a facsimile, and a laser beam printer, are used.

[Translation done.]